GEOTECHNICAL ENGINEERING EVALUATION

Mountain View Estates
Phase I

Lots 303 to 337 & 339 to 362
Pima County, Arizona

PATTISON ➢ EVANOFF ➢ ENGINEERING, LLC
Project No. 01-051

Geotechnical &
Environmental
Consultants

PATTISON ➢ EVANOFF
ENGINEERING, LLC

1129 North Winstel Boulevard
Tucson, Arizona 85716
Tel: (520) 881.1234 • Fax: 881.4919

PATTISON ➢ EVANOFF ➢ ENGINEERING, L.L.C.

Geotechnical & Environmental Consultants

1129 N. Winstel Blvd. ♦ Tucson, Az. 85716 ♦ (520) 881-1234 ♦ FAX 881-4919

Empire Interchange Limited Partnership
c/o AW Marrs, Inc.
3573 East Sunrise Drive #233
Tucson, Arizona 85718

April 4, 2001

GEOTECHNICAL ENGINEERING EVALUATION
Mountain View Estates - Phase I
Lots 303 to 337 & 339 to 362
Pima County, Arizona

Project No. 01-051

We have completed the geotechnical evaluation for the proposed Mountain View Estates - Phase I, in accordance with our Proposal Number 00-P252, dated December 7, 2000. Our project study results are attached.

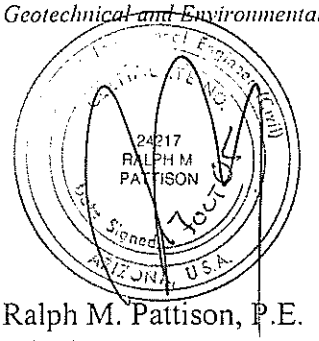
In our opinion, the site's subsurface soil conditions are suitable for the proposed development provided the report's recommendations are followed. Our evaluation showed predominantly dense to very dense gravelly sands and sandy gravels with varying amounts of silt and clay. Locally, dense sands and hard clays were encountered at depth. The soil conditions and specific recommendations are presented in the report.

We are available for consultation during the various design stages. To provide continuity of geotechnical services, we should perform construction observation and testing.

We thank you for selecting PATTISON EVANOFF ENGINEERING, L.L.C. and look forward to being a member of your team on the remainder of this project. If you have any questions about this report, or require additional consultation, please call us.

Sincerely,

PATTISON ➢ EVANOFF ➢ ENGINEERING, L.L.C.
Geotechnical and Environmental Services



Ralph M. Pattison, P.E.
Principal

Copies: Addressee (1)
Timan Land Co. as Beneficiery of Lawyers Title Trust #7035 (1)
Walbert Baker Associates, Inc. (2)

EAG: mydocs/geotech/01-051

TABLE OF CONTENTS

INTRODUCTION

This report presents the results of our geotechnical engineering services for the proposed Mountain View Estates, located northeast of I-10 and the Mountain View Interchange. The site is in the southeast and southwest quarters of Sections 26 and 27, Township 16 South, Range 16 East, of the Gila and Salt River Base and Meridian, Pima County, Arizona. The Site Plan in the Appendix shows the location of the site.

We obtained information on site conditions, performed field and laboratory testing, and performed geotechnical engineering analyses. This report presents our conclusions and recommendations regarding the engineering properties of the soils encountered and their relationship to the proposed development. Specifically, the report addresses the following information:

- General site and subsurface conditions encountered during our evaluation.
- Recommendations and design criteria for foundation systems, including allowable bearing capacity, lateral earth pressures and estimated settlements.
- Recommendations for support of concrete floor slabs.
- Recommendations for flexible pavement section.
- Recommendations for grading requirements, including site and building area preparation, fill placement, and suitability of existing soils for fill.

The Appendix contains the results of the field explorations and tests and provides a site plan showing the exploration locations.

Project Information

This phase of the planned development will have 59 residential lots located on a parcel with an area of about 90 acres. We understand that there will be a loop street of about 4500 feet within the subdivision; the street will intersect Marsh Station Road. We also assume that cuts and fills will be less than about 5 feet.

The subdivision will consist of single-family detached houses. We understand that the houses will likely be one- or two-story wood-frame or masonry structures with slab-on-grade floors. The houses are expected to have living areas of about 2000 to 4000 square feet. We are not aware of any plans to include basements in the proposed development. We are assuming that the structural loads for

continuous wall footings and column footings will be about 1 to 2 kips per linear foot and 20 kips, respectively. We also understand that houses may use post-tensioned structural foundation/slab systems.

Evaluation and Testing

To obtain information on the conditions at this site and to determine applicable soil properties, we completed an on-site evaluation. The extent of our evaluation and testing programs is described in the following section.

- **Field Evaluation**

  Richard Jones, a Field Specialist with our firm, reviewed the site to obtain information on the general surface conditions. He also observed the excavation of 11 borings between the depths of 4 and 21 feet below existing site grade. The site plan shows the approximate exploration locations. The Appendix contains logs of the subsurface conditions encountered at the explorations.

  During the field exploration, the subsurface conditions were described and the encountered soils were visually logged and sampled. We used the Unified Soil Classification System to classify soils. The soil classification symbols appear on the exploration logs and are briefly described in the Appendix.

- **Laboratory Evaluation**

  We performed laboratory analyses on soil samples to aid in material classification and estimate pertinent engineering properties of the on-site soils. We performed the tests in general accordance with applicable ASTM specifications. The Appendix contains our laboratory test results.

FINDINGS

Site Conditions

The site is native desert with a sparse to heavy growth of palo verde, mesquite, prickly pear, ocotillo, barrel, and yucca cacti. This phase of the project sits on a low ridge with surface drainage to the north, east, and west in the form of swales and small washes.

Subsurface Conditions

The soils encountered during our explorations were generally dense to very dense gravelly sands and sandy gravels with varying amounts of silt and clay. Locally, dense sands and hard clays were encountered. We encountered auger refusal at 2 of our borings at depths of 4 and 8 feet. Many factors can cause or contribute to auger refusal: strongly cemented soil; coarse gravel, cobbles, or boulders; thin rock seams; the upper surface of continuous rock; or borehole confinement. Special exploration procedures are needed to determine the character and continuity of refusal. Such procedures were not within the scope of our current services.

Soil moisture contents were low at the time of our field evaluation and no free groundwater was encountered in any of the explorations. The logs in the Appendix show details of the subsurface conditions encountered during the field evaluation.

Conclusions

In our opinion, the site's natural subsurface soil and conditions are suitable for support of the proposed development provided the designers, contractors, and owners follow the report recommendations. Our conclusions regarding the soils and planned development are given in the following discussion.

- **Compressive Properties**

  At their existing and increased moisture contents, the natural soils have low compressive potentials under the loads expected for the construction. We expect that total settlement of the proposed structures, supported as recommended, will be less than 1 inch. Differential settlement should be approximately half of the total settlement. Most settlement is expected to occur soon after construction, although additional foundation movements could occur if water from any source infiltrates the underlying soils.

- **Expansive Properties**

  The near surface soils at this site are predominately granular with nonplastic to medium plastic fines. We expect the swell potential to be low; special provisions relative to heave are therefore unnecessary.

RECOMMENDATIONS

General

All structural elements will experience at least some differential movement and the various components must accommodate this potential. We recommend that you have the Architect and the

Structural Engineer read this report and consider our comments. The basis for our comments on foundation and slab design details is primarily our experiences with recurring problems associated with many of these items.

In the following section, we provide recommendations for the supporting system that we believe is appropriate for the construction conditions. We do not intend to provide recommendations that prevent all undesirable effects resulting from structural movements. We intend to provide reasonable solutions to help control effects the soil may have on the structures.

Shallow Conventional Foundations

The proposed structures can be supported by conventional shallow, spread foundations bearing on engineered fill, natural soils, or both provided the recommendations presented in our report are followed. Engineered fill should be constructed according to the recommendations given in the ***Earthwork*** section of this report. The supporting system may consist of continuous wall footings and independent spread footings and slabs-on-grade. Monolithic foundations and slabs could be used provided they are properly designed and constructed.

The following table presents alternative foundation depths and allowable bearing pressures:

Footing Depth Below Finished Grade, ft.[1]	Allowable Bearing Pressure, psf[2]
1	1500
1.5	2000
2	2500

[1] Finished grade is the lowest adjacent grade for perimeter footings and floor level for interior footings.

[2] Allowable bearing pressures depend on compliance with the Earthwork recommendations of this report.

Footings should have minimum widths of 12 inches for walls and 24 inches for columns. Governing building codes may require greater widths. A one-third increase in the bearing pressures is allowable for transient wind or seismic loads. The bearing values given are net bearing values so the weight of the concrete in the footings may be ignored.

All footings, stemwalls, and masonry walls should be reinforced to reduce the effects of potential differential movements. Reinforcement should be consistent with structural requirements and, for monolithic designs, provide continuity through the turned-down section and the floor slab to minimize the possibility of longitudinal cracking along the wall. We suggest continuous reinforcement through these areas because we frequently see cracks in the slab portions of

monolithic construction parallel to the thickened beams. This cracking occurs because of differential movement between the slab and beam and insufficient reinforcing to resist the shear and flexural stresses. In our opinion, such differential movement should be expected because of the different loading conditions and potential variations in soil properties.

We recommend that the Geotechnical Engineer or his representative observe the site preparations and foundation excavations. The purpose of this review would be to determine if the soils and conditions are similar to those expected for support of the footings. Any soft, loose or unacceptable soils should be properly compacted and may require additional undercutting.

Shallow Post-Tensioned or Mat Foundations

To help reduce the risk of damage to foundations and slabs from differential movement, either a post-tensioned or reinforced-mat foundation and slab system could be used for the planned structures. The floor areas of these systems should, however, be supported by at least 4 inches of sand base course. If moisture-sensitive floor coverings are used, an impermeable vapor retarder should be placed beneath the floor sections. The vapor retarder should be at least 6-mil polyethylene and separated from the underside of the slab by at least 2 inches of sand. These structural systems must be designed by a Structural Engineer; we are providing the following parameters needed for the commonly used design methods:

- Allowable Bearing Capacity: 1000 psf at grade
  1500 psf at a depth of 1 foot below lowest adjacent grade
  2000 psf at a depth of 1.5 feet below lowest adjacent grade
  2500 psf at a depth of 2 feet below lowest adjacent grade
- Modulus of Subgrade Reaction: 250 kcf
- Soil Modulus of Elasticity: 3000 psi
- Coefficient of Friction: 1.0
- Differential Soil Movement, y_m: ¾-inch along a wall span of 25 feet*

* This settlement value is based on a depth of wetting of 2 feet beneath the foundations. Additional wetting of the underlying soil could cause further settlement of about ½-inch per foot of wetted soil.

A one-third increase in the bearing pressure is allowable for transient wind or seismic loads. The bearing values given are net bearing values so the weight of the concrete in the footings may be ignored. The Structural Engineer should specify the concrete strength, concrete strength required for

post-tensioning, required thicknesses of elements, post-tensioning force, and expected post-tensioning cable elongation.

Although post-tensioning the foundation and slabs will close cracks that form during hydration, it is still beneficial to properly cure the concrete. The proper curing of concrete, especially for flatwork (slabs), is extremely important in minimizing plastic shrinkage cracks and slab curling. We believe that many slab cracking problems can be mitigated or possibly eliminated by proper curing. We strongly suggest moist-curing slabs for at least a week after placement. Curing promotes more complete hydration of the cement and reduces plastic drying shrinkage, especially near the exposed upper portion of the slab. Alternatively, moist-curing for several days and then applying a liquid membrane curing compound would also be beneficial. Also important are the mix design and quality control during construction.

All concrete placement and curing operations should follow recommendations of the American Concrete Institute manual. Improper curing and excessive slump (water-cement ratio) could cause excessive shrinkage, cracking, or curling of the concrete. Concrete slabs should be allowed to cure adequately before placing vinyl or other moisture-sensitive floor covering.

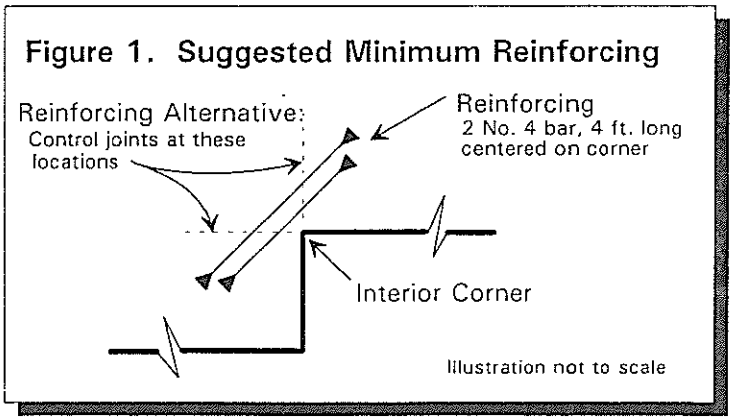
Floor Slabs

Floor slabs may be supported on properly placed and compacted fill. The contractor should prepare the slab subgrade, subbase fill, and base course as outlined in the ***Earthwork*** section of this report. For lightly loaded slabs, a minimum 4-inch layer of base course should be provided beneath all slabs to provide more uniform support and help prevent capillary rise and a damp slab.

The slab thickness, concrete strength, and reinforcing should be designed by a Structural Engineer. We recommend that slabs supporting typical light loads be at least 4 inches thick. We believe using reinforcing steel in slabs is beneficial for minimizing cracks and strengthening the cross-section in the event tensile or flexural stresses develop. If a *nonreinforced* slab is chosen, we still suggest using steel reinforcing at least in interior or re-entrant corners.

Reinforcing should be placed diagonally across the interior projection of corners as shown in Figure 1. Reinforcement should be positioned as near the mid-height of the slab as possible while maintaining codes. Alternatively, control joints may be used for this situation as shown in Figure 1.

Figure 1. Suggested Minimum Reinforcing



Slabs should be jointed around columns and along footing supported walls so the slab and footings are able to settle independently. If steel reinforcing is not used, we recommend using a fibermesh additive to the concrete to aid in controlling cracks from drying shrinkage and thermal changes.

To provide stress relief and help eliminate random cracking, we suggest providing control joints at spacings less than 15 feet. Wider joint spacings are possible depending on the slab thickness, absence or presence of reinforcing, concrete mix design, and the curing environment. The joint locations should be determined by the Structural Engineer. Joint locations should be developed considering such items as shrinkage potential, slab thickness, curing, fixed element restrictions, slab penetrations, type of floor covering, and specialized equipment placement.

The proper curing of concrete, especially for flatwork (slabs), is extremely important in minimizing plastic shrinkage cracks and slab curling. We believe that many slab cracking problems can be mitigated or even eliminated by proper curing. We strongly suggest moist-curing slabs for at least a week after placement. Curing promotes more complete hydration of the cement and reduces plastic drying shrinkage, especially near the exposed upper portion of the slab. Alternatively, moist-curing for several days and then applying a liquid membrane curing compound would also be beneficial. Also important are the mix design and quality control during construction.

All concrete placement and curing operations should follow recommendations of the American Concrete Institute manual. Improper curing and excessive slump (water-cement ratio) could cause excessive shrinkage, cracking, or curling of the concrete. Concrete slabs should be allowed to cure adequately before placing vinyl or other moisture-sensitive floor covering. To prevent incomplete bonding, distortion, and water vapor entrapment, flooring should not be placed until the moisture content of the slab is at or below the manufacturer's requirements.

Lateral Earth Pressures

For cantilevered walls above any free water surface with level backfill and no surcharge loads, the recommended equivalent fluid pressures and coefficients of base friction are presented in the table on the following page.

EARTH PRESSURE STATE		EQUIVALENT FLUID PRESSURE, psf/ft
Active		
	Undisturbed Native Soil	35
	Granular Backfill	30
Passive		
	Undisturbed Native Soil	375
	Granular Backfill	450
At-rest		
	Undisturbed Native Soil	54
	Granular Backfill	50
Coefficient of Base Friction = 0.45*		

* For short retaining walls with minimal cover on the outside face, the coefficient of base friction should be reduced to 0.35 when used in conjunction with passive pressure.

We do not expect submerged soil conditions; the lateral earth pressures shown therefore do not include this condition. We should be consulted for additional recommendations if submerged conditions are to be included in the design. Any surcharge from adjacent loading will also increase the lateral pressure and must be added to the above earth pressures.

The contractor should use granular, relatively free-draining soil for retaining wall backfill to reduce the potential for hydrostatic pressure buildup. Retaining walls should be designed with a backdrain that either drains to lower ground or to a sump with a float-activated pump. The level of this drain should be lower than the lowest retained earth behind the wall; the perforations in the drain pipe should be at least 8 inches lower than the top of any interior slabs in front of the wall.

Properly place and compact all backfill as recommended in this report. Cobbles, if present, should be removed from the soils placed adjacent to walls so high-intensity point loads do not occur. Avoid nesting of larger particles because voids could form and cause subsidence of the backfill.

Waterproof the exterior face of below-grade walls that are exposed to interior living spaces to retard moisture penetration. It is important that all backfill be properly placed and compacted. Mechanically compact all backfill in layers. Water settling or flooding is not acceptable. Care should be taken to avoid damaging the walls when placing the backfill. Backfill should be inspected and tested during placement and compaction, especially if there will be overlying elements supported by the backfill such as foundations, stairs, walls, and planters.

Flexible Pavement Section

For the pavement section designs, we used a change in serviceability index and a percent reliability appropriate for the proposed pavement section. The average correlated R-Value from our laboratory tests was 44. Using a seasonal variation factor of 1.7, we determined a resilient modulus of 19,834 psi.

We used surfacing and base coefficients of 0.44 for asphalt concrete and 0.12 for aggregate base course. We selected this asphalt concrete coefficient because the local suppliers produce asphalt concrete with a Marshall Stability greater than 2000 which, based on ADOT criteria, gives a maximum coefficient of 0.44 (Figure 202.02-3 of the 1989 ADOT *Preliminary Engineering and Design Manual*).

For the interior roadways providing access to the lots, we assumed a maximum average daily traffic of 290 vehicles per day. The assumed vehicle breakdown and resultant 20-year ESAL are provided in the following table:

DEVELOPMENT OF DESIGN ESAL			
VEHICLE TYPES	PERCENT OF TRAFFIC	ESAL FACTOR	20 YEAR DESIGN ESAL
Automobiles	65	0.0008	1,101
Pickup Trucks	30	0.0120	7,621
Medium Trucks	5	0.1890	20,006
All Vehicles	100	TOTAL ESAL	28,728

From the pavement design equation provided in the 1989 ADOT *Preliminary Engineering and Design Manual*, we determined a structural number of 1.13. In keeping with the Pima County Department of Transportation and Flood Control District - Subdivision Street Standards, we used the minimum of 1.36. The recommended pavement section is provided in the following table. We should be consulted for possible supplemental recommendations if additional information showing the amounts and types of traffic becomes available.

For arterial roadways providing access to Marsh Station Road, we assumed a maximum average daily traffic of 1,700 vehicles per day. The assumed vehicle breakdown and resultant 20-year ESAL are provided in the following table:

DEVELOPMENT OF DESIGN ESAL			
VEHICLE TYPES	PERCENT OF TRAFFIC	ESAL FACTOR	20 YEAR DESIGN ESAL
Automobiles	65	0.0008	6,453
Pickup Trucks	30	0.0120	44,676
Medium Trucks	5	0.1890	117,275
All Vehicles	100	TOTAL ESAL	168,404

From the pavement design equation provided in the 1989 ADOT *Preliminary Engineering and Design Manual*, we determined a structural number of 1.13. In keeping with the Pima County Department of Transportation and Flood Control District - Subdivision Street Standards, we used the minimum of 1.36. The recommended pavement section is provided in the following table. We should be consulted for possible supplemental recommendations if additional information showing the amounts and types of traffic becomes available.

AREA	ASPHALT CONCRETE, in.		BASE COURSE, in.
Interior Roadways	2		4
Arterial Streets Accessing Marsh Station Road	Current Phase	2	5
	Future Phases	2.5	5

Thinner pavement sections could be used, but would result in reduced pavement life and increased maintenance costs. Bituminous surfacing should be dense-graded, central-plant-mix, asphalt concrete. Base course and asphalt concrete should conform with Pima County/City of Tucson specifications.

Exterior Features

Exterior slabs-on-grade, exterior architectural features, and utilities may experience some movement due to the volume change of the underlying soils. The potential for movement and resulting distress could be reduced by the following measures:

- Minimizing moisture increases in the soil
- Moisture-density control during placement of soil
- Use of designs which allow vertical movement between the exterior features and adjoining structural elements

- Placement of effective control joints on relatively close centers
- Allowance for vertical movements in utility connections

Temporary Construction Excavations

Temporary unsurcharged construction excavations should be sloped or shored. Slopes should not be steeper than 1 to 1 (horizontal to vertical) in the natural soil. Slopes may need to be flattened depending on conditions exposed during construction. If there is not enough space for sloped excavations, shoring should be used.

Various shoring systems are possible; their selection and design, however, is beyond the scope of our current evaluation. The design of a retaining system is dependent on the construction method, the sequence of operations, and adjacent construction. The contractor's and designer's responsibilities for design and construction should be clearly defined. Exposed slopes should be kept moist (but not saturated) during construction. Traffic and surcharge loads should be at least 10 feet from the top of the excavation. All excavations should be completed in accordance with the most recent OSHA requirements.

Slopes and Soil Erodibility

Both cut and fill slopes should be 2 to 1 (horizontal to vertical) or flatter and should be covered as quickly as possible with grass or other covers such as mulch, rock mulch, or jute mesh to avoid unnecessary soil losses.

Slopes should be scraped or raked across the slopes (perpendicular to flow), unless they are *trackwalked*, to aid in providing greater infiltration rates of surface water. If the slopes are shaped by *trackwalking*, with tracked vehicles, they should be worked up and down as the tread imprints will create grooves parallel to the slope which will aid infiltration rates and trap seeds.

During construction, graded unprotected areas should retain as much natural vegetation as possible. Vegetation along the perimeters of graded areas should be left intact to control erosion and serve as a sediment trap. Exposed soil areas should be sprinkled with water during construction to reduce transportation of soil by wind. If rains are anticipated during construction, flows over the disturbed areas can be minimized by diverting upslope surface water with berms or ditches.

Erosion will increase soil loss and could cause loss of support to structures and other facilities. Periodic maintenance and prompt repair of erosional features is important to prevent unnecessary soil losses. The effectiveness of erosion control should be evaluated after heavy or prolonged rains.

Surface Drainage

The major cause of soil problems in this region is moisture increase in soils below structures. It is therefore extremely important to provide positive drainage away from the structures, both during construction and throughout its life. Infiltration of water into utility or foundation excavations must be prevented.

Waterlines and sewerlines should be carefully tested and inspected for leaks prior to backfilling. Planters and other surface features that could retain water in areas adjacent to the structures should be eliminated or constructed so that accumulated water is discharged onto a positive gradient at least 5 feet from the structures. Roof rainwater should also be collected and discharged onto a positive gradient at least 5 feet from the structures. Water from cooling unit condensation and water heater drains should be contained in sealed conduits and discharged to a positive gradient at least 5 feet beyond the structures.

In areas where sidewalks or paving do not immediately adjoin the structures, protective slopes should be provided with an outfall of at least 3 percent for at least 5 feet from perimeter walls. Backfill against footings, exterior stemwalls, and in utility and sprinkler line trenches should be well compacted and free of all construction debris to minimize the possibility of moisture infiltration.

Some drainage facilities, such as rock-lined drainage swales, often degrade over time and become inefficient or ineffective. The potential harmful effects of water infiltrating the supporting soils beneath the structures must be made clear to the owners.

Construction Review

We recommend that the Geotechnical Engineer or his representative observe the site preparations and foundation bearing conditions. The purpose of this review would be to determine if the soils and conditions are similar to those expected for support of the footings. Any soft, loose or unacceptable soils should be properly compacted and may require supplemental recommendations.

We recommend surveying the finished floor elevation of all slabs-on-grade and maintaining this record. In the event of future movement, this information could be extremely helpful in assessing the conditions and providing remedial measures.

EARTHWORK

General

Our recommendations for foundations, slabs, and pavement supported on compacted fills or prepared subgrade depend on compliance with the recommendations presented in this section. Observation and testing of earthwork, supervised or performed by a geotechnical engineer, is necessary to assess compliance with these recommendations.

During our field evaluation we did not observe any underground facilities such as septic tanks, cesspools, basements and utilities. However, such features may exist.

Site Clearing

Strip and remove existing fill, vegetation, debris, loose or wet soil and other deleterious materials from the building areas and at least 5 feet beyond. The contractor should remove any remaining construction from the proposed building areas. If pipes and other underground structures are not removed, they may serve as conduits for subsurface erosion resulting in voids and possible settlement of overlying facilities. Over-excavated areas resulting from removal of underground facilities and unsuitable materials should be backfilled as recommended in this report. All exposed surfaces should be free of mounds and depressions that could prevent uniform compaction.

In areas that will receive fill, slopes steeper than 5 to 1 (horizontal to vertical) should be benched to reduce potential slippage between slopes and fills. Benches should be reasonably level and wide enough to allow appropriate use of compaction and earth-moving equipment on a level plane.

Excavation

Excavation of near-surface soils should be possible with conventional equipment. Locally, areas that encounter strongly cemented soils may need ripping or similar excavation techniques. The speed and ease of excavating will depend on the type of grading equipment, the skill of the operators and the structure of the deposit. If more information regarding excavation is desired, we suggest a study using equipment similar to that expected for the actual construction. The information contained in this report is intended for design and preliminary estimating purposes. Contractors reviewing the report must draw their own conclusions regarding the types of equipment and methods required to complete the construction.

Foundation Preparation

Specialized treatment of the existing *undisturbed* natural soils in foundation areas is unnecessary. However, foundation excavations should be reviewed by the Geotechnical Engineer or his

representative prior to placing reinforcing steel and concrete to determine if the soils and conditions are as expected.

The contractor should construct the engineered fill in a manner resulting in *uniform* water contents and densities after compaction. All engineered fill should be constructed according to the report requirements. The contractor should notify the Geotechnical Engineer if the soil conditions vary significantly from those shown in this report or if there are any questions regarding the type of soil or its condition.

Floor Slab Preparation

The contractor should scarify and recompact the exposed subgrade soil to a depth of at least 10 inches. This includes areas to be filled and exposed cut-to-grade areas. The contractor should notify the Geotechnical Engineer if the soil conditions vary significantly from those shown in this report or if there are any questions regarding the type of soil or its condition.

The contractor should construct the engineered fill in a manner resulting in *uniform* water contents and densities after compaction. Place and compact at least four inches of base course beneath interior slabs to provide more uniform support and help prevent a damp slab. This four-inch thickness of base course may be included in the required amount of engineered fill.

Pavement Preparation

Scarify, moisten or dry as required, and compact exposed subgrade to a depth of at least 10 inches prior to placing pavement materials.

Materials

Imported soils and existing granular soils with low expansive potentials and all particles passing the 6-inch sieve may be used as fill material for the following areas:

- Foundation areas
- Interior slab areas
- Pavement areas
- Backfill

Imported soils should conform to the following requirements:

IMPORT SOIL PROPERTIES	
SIEVE SIZE	PERCENT PASSING, by dry weight
6"	100
No. 4	50-100
No. 200	60 max.
Maximum Expansive Potential = 1.5%*	
Maximum Soluble Sulfates = 0.10%	

* Measured on a sample compacted to approximately 95 percent of the ASTM D698 maximum dry density at about three percent below optimum water content. The sample is confined under a 100 psf surcharge and submerged.

Sand base course below concrete floor slabs should conform to the following requirements:

SAND BASE COURSE	
SIEVE SIZE	PERCENT PASSING, by dry weight
3/4"	100
3/8"	90 to 100
No. 4	70 to 95
No. 10	65 to 90
No. 40	15 to 40
No. 200	15 max.
Plasticity Index = 5 max.	

Placement and Compaction

Place and compact fill in horizontal lifts using equipment and procedures that will produce the recommended moisture contents and densities throughout the lift.

Materials should be compacted to the following standards at near optimum moisture contents:

Soil Type and Area		Minimum Percent Compaction, ASTM D-698
On-site subgrade soils, on-site soils as subbase fill, and imported soils*		
	Below foundations**	95
	Below slabs-on-grade	95
	Below pavement	95
Base Course below slabs		95
Base Course below pavement		100
Non-structural backfill, *not providing lateral or vertical support of structural elements*		90

* Fill 5 feet or more below finished grade should be compacted to at least 100 percent of ASTM D-698.

** Undisturbed natural soils below foundations do not require compaction.

CLOSURE

Additional Services

Field observation and testing during construction, and reviewing the plans and specifications are integral factors in developing and implementing our conclusions and recommendations. Our involvement during construction is important to observe compliance with the design concepts, specifications, or recommendations, and to allow efficient design changes if the subsurface conditions differ from those anticipated. PATTISON EVANOFF ENGINEERING, L.L.C. offers these services and is the most qualified to determine consistency of field conditions with the data used in our analyses. It is the client's responsibility to make this report available, in its entirety, to all design team members, contractors, and owners.

Limitations

The services we performed for this project include professional opinions and judgments based on the data collected. We performed our professional services using the degree of care and skill ordinarily exercised, under similar circumstances, by reputable geotechnical engineers practicing in southern Arizona. We do not intend to provide recommendations that prevent all undesirable effects resulting from structural movements. We intend to provide reasonable solutions to help control effects the soil may have on the structure. We make no other warranty, expressed or implied.

We prepared the report as an aid for the design of the project. This report is not a bidding document and any contractors reviewing it must draw their own conclusions regarding site conditions and specific construction techniques to be used on this project.

Our services did not include any environmental assessment or investigation for the presence or absence of hazardous or toxic materials in the soil, groundwater, or air, on or below or around, this site. All conditions documented or observed are strictly for the information of our client. If environmental information is required, we recommend that an environmental assessment be completed which addresses these concerns.

We based our recommendations on the assumption the soil and groundwater conditions across the site are similar to those encountered at the boring locations. The extent and nature of subsurface soil and groundwater variations may not be evident until construction. If conditions encountered during construction appear to differ from those described in this report, we should be consulted to assess the impact and provide supplemental recommendations. Our evaluation and report does not include the effects, if any, of underlying geologic hazards or regional groundwater withdrawal and we express no opinion regarding their effects on surface movement.

APPENDIX

Geotechnical,

Materials &

Environmental

Consultants

UNIFIED SOIL CLASSIFICATION SYSTEM
CLASSIFICATION PROCEDURE

ANY SOIL

- Less than 50% Fines
  - *General Grouping*: Coarse Grained *(Sieve Analysis)*
  - *First Letter*: Whichever is present in Greatest Amount — SAND (S) GRAVEL (G)
  - *(Percent and Plasticity of Fines)*
    - <5% Fines
      - *Second Letter*

	GW	SW
C_u	>4	>6
C_c	1-3	1-3

      - GW / GP / SW / SP
    - 5-12% Fines — *(Gradation and Type of Fines)*: GW-GM, GW-GC, GP-GM, GP-GC / SW-SM, SW-SC, SP-SM, SP-SC
    - 12-49% Fines — *(Type of Fines Plasticity Chart)*: GC / GM / SC / SM
- Fibrous Organic Peat or Moss — Pt
- More than 50% Fines
  - Fine Grained *(Plasticity Chart)*
  - Below A-Line-SILT (M); Above A-Line-CLAY (C); Color & Odor-Organic (O)
  - *(Value of Liquid Limit)*
    - w_L < 50 *(Low Compressibility)*: CL / ML / OL
    - w_L > 50 *(High Compressibility)*: CH / MH / OH

PHYSICAL PROPERTIES OF SOILS

GRAIN SIZE CHART

CLASSIFICATION	U.S. Standard Sieve Size
BOULDERS	Above 12"
COBBLES	12" to 3"
GRAVEL	3" to No.4
Coarse	3" to 3/4"
Fine	3/4" to No.4
SAND	No.4 to No.200
Coarse	No.4 to No.10
Medium	No.10 to No.40
Fine	No.40 to No.200
SILT & CLAY	Below No. 200

Coarse Grained Scale

(50% retained on #200 sieve)

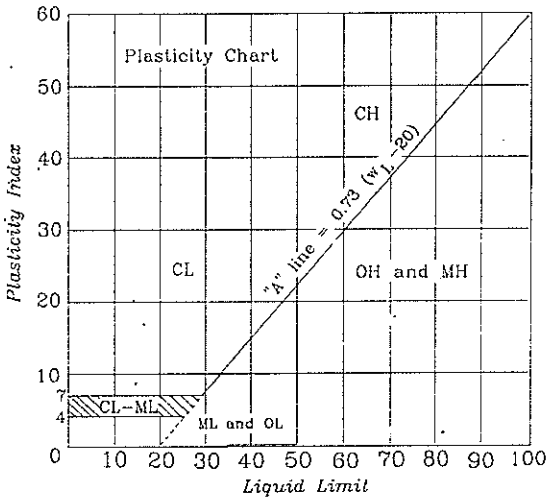
ADJECTIVE	%
trace	0-10
some	10-20
with	20-30
"-y" or "-ey"	30-50

P = poorly graded
W = well graded

P.I.	*ADJECTIVE*
< 1	non-plastic
1-10	low plasticity
11-25	medium plasticity
>25	high plasticity

FINE GRAINED SOILS

(50% passing #200 sieve)



L = low compressibility
H = high compressibility

PATTISON ➢ EVANOFF ➢ ENGINEERING, L.L.C.

Geotechnical & Environmental Consultants

METHOD OF SOIL CLASSIFICATION

Mountain View Estates - Phase I
Northeast of I-10 and Sonoita Highway
Pima County, Arizona

Project No. 01-051 | EAG | 20MAR01

The number shown in **Boring No.** refers to the approximate location of the same number shown on the **Site Plan** as positioned in the field by pacing from property lines and/or existing features.

The number shown in **Blows/6"** refers to the number of blows of a 140-pound weight dropped 30 inches, required to advance the sampler. **H** in **Sample Type** is a hand sample from the auger cuttings. **RS** in **Sample Type** is a 2.42-inch-inside-diameter ring sampler. Refusal to penetration for the ring sampler is considered more than 50 blows per foot. **SS** in **Sample Type** is a 2.0-inch-outside-diameter split-spoon sampler. This sampler is used to perform the Standard Penetration Test (SPT) ASTM D1586. Refusal to penetration is considered to be one of the following items: 1. A total of 50 blows has been applied during any one of the three 6-inch increments; 2. A total of 100 blows has been applied; 3. There is no observed advance of the sampler during application of 10 successive blows of the hammer.

USCS Code refers to the soil type as defined by the **Unified Soil Classification System.** The soils were visually classified in the field and, where appropriate, classifications were modified by visual examination of samples in the laboratory and by appropriate test.

These notes and boring logs are intended for use in conjunction with the purposes of our services defined in the text. Boring log data should not be construed as part of the construction plans or as defining construction conditions.

Boring logs depict our interpretations of subsurface conditions at the locations and on the date(s) shown. Variations in subsurface conditions and soil characteristics may occur between borings. Groundwater levels may fluctuate due to seasonal variations and other factors.

In general, terms and symbols on the boring logs conform with **"Standard Definitions of Terms and Symbols Relating to Soil and Rock Mechanics"** (ASTM D653).

PATTISON EVANOFF ENGINEERING, L.L.C.

1129 North Winstel Boulevard Tucson, Arizona 85716 Phone: (520) 881-1234

BORING NUMBER **B-1** SHEET 1 OF 1

Client: Pima Land Co./Empire Interchange L.P.

Project: Mountain View Estates, Phase I
Location: North of Marsh Station Road, East of SR.83

Location of Boring: SEE SITE PLAN

Elevation: Datum:

Logged By: R.J. Date: 02/21/01

Surface Conditions or Remarks: Native desert

SAMPLE TYPE	BLOWS PER 6"	INCHES DRIVEN/ INCHES RECOV'D	BULLNOSE BLOWS/FT	DEPTH (FEET)	USCS CODE	DESCRIPTION OF SUBSURFACE CONDITIONS	DRY DENSITY (PCF)	MOISTURE (%)
H				1	SC	GRAVELLY SAND with clay; brown, slightly moist, medium dense, low to medium plasticity, 5-20% cobbles		
RS	28 22/3	9/9		2	CL/CH	CLAY with sand and gravel; very light brown, dry, dense to very dense, medium to high plasticity, 5-20% cobbles, strong cementation		
				3				
				4	SM/GM	GRAVELLY SAND/SANDY GRAVEL, some silt; light brown, dry, very dense, nonplastic, 25-40% cobbles, moderate cementation		
SS	50/6	6/3		5				
				6				
				7				
				8				
				9				
				10		BOTTOM OF HOLE AT 10 FEET *No Free Water Encountered*		
				11				
				12				
				13				
				14				
				15				
				16				
				17				
				18				
				19				
				20				
				21				
				22				
				23				
				24				
				25				

Sample Type Key:
SS = Split Spoon
RS = Ring Sampler
AC = Auger Cuttings
H = Hand Sample
R = Refusal

Drilling Equipment:
Mobile B-53 Drill Rig equipped with 6-5/8" OD x 3-1/4" ID hollow-stem, continuous-flight auger

PATTISON EVANOFF ENGINEERING, L.L.C.

1129 North Winstel Boulevard Tucson, Arizona 85716 Phone: (520) 881-1234

BORING NUMBER **B-2** SHEET 1 OF 1

Client: Pima Land Co./Empire Interchange L.P.

Project: Mountain View Estates, Phase I
Location: North of Marsh Station Road, East of SR.83

Location of Boring: SEE SITE PLAN

Elevation: Datum:

Logged By: R.J. Date: 02/21/01

Surface Conditions or Remarks: Native

SAMPLE TYPE	BLOWS PER 6"	INCHES DRIVEN/ INCHES RECOV'D	BULLNOSE BLOWS/FT	DEPTH (FEET)	USCS CODE	DESCRIPTION OF SUBSURFACE CONDITIONS	DRY DENSITY (PCF)	MOISTURE (%)
				1	SM	GRAVELLY SAND with silt; brown, slightly moist, medium dense, nonplastic, 5-20% cobbles		
RS	35 15/2	8/8		2		Some silt; light brown, very dense, moderate cementation		
				3				
				4				
RS	23 27/5	11/11		5				
				6				
				7				
				8				
				9				
SS	21 35 40	18/12		10				
				11				
				12		BOTTOM OF HOLE AT 11 FEET 6 INCHES *No Free Water Encountered*		
				13				
				14				
				15				
				16				
				17				
				18				
				19				
				20				
				21				
				22				
				23				
				24				
				25				

Sample Type Key:
SS = Split Spoon H = Hand Sample
RS = Ring Sampler R = Refusal
AC = Auger Cuttings

Drilling Equipment:
Mobile B-53 Drill Rig equipped with 6-5/8" OD x 3-1/4" ID hollow-stem, continuous-flight auger

PATTISON EVANOFF ENGINEERING, L.L.C.

1129 North Winstel Boulevard Tucson, Arizona 85716 Phone: (520) 881-1234

BORING NUMBER **B-3** SHEET 1 OF 1

Client: Pima Land Co./Empire Interchange L.P.

Project: Mountain View Estates, Phase I
Location: North of Marsh Station Road, East of SR.83

Location of Boring: SEE SITE PLAN

Elevation: Datum:

Logged By: R.J. Date: 02/21/01

Surface Conditions or Remarks: Native

SAMPLE TYPE	BLOWS PER 6"	INCHES DRIVEN/ INCHES RECOV'D	BULLNOSE BLOWS/FT	DEPTH (FEET)	USCS CODE	DESCRIPTION OF SUBSURFACE CONDITIONS	DRY DENSITY (PCF)	MOISTURE (%)
H				1	SM	GRAVELLY SAND with silt; brown, slightly moist, medium dense, nonplastic, 5-20% cobbles		
				4	SC/GC	GRAVELLY SAND/SANDY GRAVEL with clay; very light brown, dry to slightly moist, nonplastic, 20-35% cobbles, medium cementation		
				10		AUGER REFUSAL AT 10 FEET *No Free Water Encountred*		

Sample Type Key:
SS = Split Spoon H = Hand Sample
RS = Ring Sampler R = Refusal
AC = Auger Cuttings

Drilling Equipment:
Mobile B-53 Drill Rig equipped with 6-5/8" OD x 3-1/4" ID hollow-stem, continuous-flight auger

PATTISON EVANOFF ENGINEERING, L.L.C.

1129 North Winstel Boulevard Tucson, Arizona 85716 Phone: (520) 881-1234

BORING NUMBER **B-4**
SHEET 1 OF 1

Client: Pima Land Co./Empire Interchange L.P.

Project: Mountain View Estates, Phase I
Location: North of Marsh Station Road, East of SR.83

Location of Boring: SEE SITE PLAN

Elevation: Datum:

Logged By: R.J. Date: 02/21/01

Surface Conditions or Remarks:

SAMPLE TYPE	BLOWS PER 6"	INCHES DRIVEN/ INCHES RECOV'D	BULLNOSE BLOWS/FT	DEPTH (FEET)	USCS CODE	DESCRIPTION OF SUBSURFACE CONDITIONS	DRY DENSITY (PCF)	MOISTURE (%)
RS	9 21	12/4		1 2 3 4	SC	CLAYEY SAND with gravel; brown, slightly moist, medium dense, medium plasticity Dense	122	10.7
RS	50/5	5/4		5 6 7 8	SP/GP	GRAVELLY SAND/SANDY GRAVEL, trace silt; brown, dry, very dense, nonplastic, 20-35% cobbles, weak cementation		
				9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25		AUGER REFUSAL AT 8 FEET ***No Free Water Encountered***		

Sample Type Key:
SS = Split Spoon H = Hand Sample
RS = Ring Sampler R = Refusal
AC = Auger Cuttings

Drilling Equipment:
Mobile B-53 Drill Rig equipped with 6-5/8" OD x 3-1/4" ID hollow-stem, continuous-flight auger

PATTISON EVANOFF ENGINEERING, L.L.C.

1129 North Winstel Boulevard Tucson, Arizona 85716 Phone: (520) 881-1234

BORING NUMBER **B-5** SHEET 1 OF 1

Client: Pima Land Co./Empire Interchange L.P.

Project: Mountain View Estates, Phase I
Location: North of Marsh Station Road, East of SR.83

Location of Boring: SEE SITE PLAN

Elevation: Datum:

Logged By: R.J. Date: 02/21/01

Surface Conditions or Remarks: Native

SAMPLE TYPE	BLOWS PER 6"	INCHES DRIVEN/ INCHES RECOV'D	BULLNOSE BLOWS/FT	DEPTH (FEET)	USCS CODE	DESCRIPTION OF SUBSURFACE CONDITIONS	DRY DENSITY (PCF)	MOISTURE (%)
H				1	SC	CLAYEY SAND with gravel; brown, slightly moist, medium dense to dense, medium plasticity		
RS	10 15	12/4		2			119	9.2
				3				
				4				
				5		Light brown dry, very dense, strong cementation		
RS	36 14/2	8/3		6				
				7		Gravelly		
				8				
				9				
				10	CL	CLAY with sand, some gravel; light brown, dry, hard, medium to high plasticity, strong cementation		
SS	50/6	6/4		11				
				12				
				13				
				14				
				15				
SS	20 50/6	12/8		16		BOTTOM OF HOLE AT 16 FEET *No Free Water Encountered*		
				17				
				18				
				19				
				20				
				21				
				22				
				23				
				24				
				25				

Sample Type Key:
SS = Split Spoon H = Hand Sample
RS = Ring Sampler R = Refusal
AC = Auger Cuttings

Drilling Equipment:
Mobile B-53 Drill Rig equipped with 6-5/8" OD x 3-1/4" ID hollow-stem, continuous-flight auger

PATTISON EVANOFF ENGINEERING, L.L.C.

1129 North Winstel Boulevard Tucson, Arizona 85716 Phone: (520) 881-1234

BORING NUMBER **B-6** SHEET 1 OF 1

Client: Pima Land Co./Empire Interchange L.P.

Project: Mountain View Estates, Phase I
Location: North of Marsh Station Road, East of SR.83

Location of Boring: SEE SITE PLAN

Elevation: Datum:

Logged By: R.J. Date: 02/21/01

Surface Conditions or Remarks: Native

SAMPLE TYPE	BLOWS PER 6"	INCHES DRIVEN/ INCHES RECOV'D	BULLNOSE BLOWS/FT	DEPTH (FEET)	USCS CODE	DESCRIPTION OF SUBSURFACE CONDITIONS	DRY DENSITY (PCF)	MOISTURE (%)
				1	SM	GRAVELLY SAND with silt; brown, slightly moist, loose nonplastic		
RS	6 7	12/4		2	SC	GRAVELLY SAND some clay; reddish brown, slightly moist, loose to medium dense, low plasticity, 5-20% cobbles		
				3				
				4				
RS	13 26	12/12		5				
				6	SP	SAND with gravel trace of silt; light brown, dry, very dense, nonplastic		
				7				
				8		Gravelly, 5-20% cobbles		
				9				
				10		BOTTOM OF HOLE AT 10 FEET ***No Free Water Encountered***		
				11				
				12				
				13				
				14				
				15				
				16				
				17				
				18				
				19				
				20				
				21				
				22				
				23				
				24				
				25				

Sample Type Key:
SS = Split Spoon H = Hand Sample
RS = Ring Sampler R = Refusal
AC = Auger Cuttings

Drilling Equipment:
Mobile B-53 Drill Rig equipped with 6-5/8" OD x 3-1/4" ID hollow-stem, continuous-flight auger

PATTISON EVANOFF ENGINEERING, L.L.C.

1129 North Winstel Boulevard Tucson, Arizona 85716 Phone: (520) 881-1234

BORING NUMBER **B-7**
SHEET 1 OF 1

Client: Pima Land Co./Empire Interchange L.P.

Project: Mountain View Estates, Phase I
Location: North of Marsh Station Road, East of SR.83

Location of Boring: SEE SITE PLAN

Elevation: Datum:

Logged By: R.J. Date: 02/21/01

Surface Conditions or Remarks: Native

SAMPLE TYPE	BLOWS PER 6"	INCHES DRIVEN/ INCHES RECOV'D	BULLNOSE BLOWS/FT	DEPTH (FEET)	USCS CODE	DESCRIPTION OF SUBSURFACE CONDITIONS	DRY DENSITY (PCF)	MOISTURE (%)
				1	SM	GRAVELLY SAND with silt; brown, slightly moist, medium dense, nonplastic; 5-20% cobbles		
				2		Some silt, very dense, moderate cementation		
				3				
				4				
				5				
				6	SP	GRAVELLY SAND trace silt; light brown, dry, very dense, nonplastic , 10-25% cobbles, weak cementation		
				7				
				8				
				9				
				10		BOTTOM OF HOLE AT 10 FEET *No Free Water Encountered*		
				11				
				12				
				13				
				14				
				15				
				16				
				17				
				18				
				19				
				20				
				21				
				22				
				23				
				24				
				25				

Sample Type Key:
SS = Split Spoon H = Hand Sample
RS = Ring Sampler R = Refusal
AC = Auger Cuttings

Drilling Equipment:
Mobile B-53 Drill Rig equipped with 6-5/8" OD x 3-1/4" ID hollow-stem, continuous-flight auger

PATTISON EVANOFF ENGINEERING, L.L.C.

1129 North Winstel Boulevard Tucson, Arizona 85716 Phone: (520) 881-1234

BORING NUMBER **B-8**

SHEET 1 OF 1

Client: Pima Land Co./Empire Interchange L.P.

Project: Mountain View Estates, Phase I
Location: North of Marsh Station Road, East of SR.83

Location of Boring: SEE SITE PLAN

Elevation: Datum:

Logged By: R.J. Date: 02/21/01

Surface Conditions or Remarks:

SAMPLE TYPE	BLOWS PER 6"	INCHES DRIVEN/ INCHES RECOV'D	BULLNOSE BLOWS/FT	DEPTH (FEET)	USCS CODE	DESCRIPTION OF SUBSURFACE CONDITIONS	DRY DENSITY (PCF)	MOISTURE (%)
				1	SC/GC	GRAVELLY SAND/SANDY GRAVEL with clay; brown, slightly moist, dense, medium plasticity, 15-30% cobbles		
				2				
SS	9	18/12		3				
	26			4	SC	GRAVELLY SAND some clay; light brown, dry, very dense, low plasticity, 15-30% cobbles, moderate cementation		
	29			5				
				6				
				7				
SS	26	12/6		8				
	50/6			9				
				10				
				11	SP/GP	GRAVELLY SAND/SAND GRAVEL trace silt; light brown, dry, very dense, nonplastic, 15-30% cobbles		
				12				
				13				
				14				
SS	50/6	6/6		15				
				16				
				17				
				18				
				19				
				20				
SS	30	11/5		21	CL/CH	CLAY, some sand, trace gravel, brown, dry, hard, medium to high plasticity		
	50/5			22		BOTTOM OF HOLE AT 20 FEET 11 INCHES *No Free Water Encountered*		
				23				
				24				
				25				

Sample Type Key:
SS = Split Spoon H = Hand Sample
RS = Ring Sampler R = Refusal
AC = Auger Cuttings

Drilling Equipment:
Mobile B-53 Drill Rig equipped with 6-5/8" OD x 3-1/4" ID hollow-stem, continuous-flight auger

PATTISON EVANOFF ENGINEERING, L.L.C.

1129 North Winstel Boulevard Tucson, Arizona 85716 Phone: (520) 881-1234

BORING NUMBER **B-9** SHEET 1 OF 1

Client: Pima Land Co./Empire Interchange L.P.

Project: Mountain View Estates, Phase I
Location: North of Marsh Station Road, East of SR.83

Location of Boring: SEE SITE PLAN

Elevation: Datum:

Logged By: R.J. Date: 02/21/01

Surface Conditions or Remarks:

SAMPLE TYPE	BLOWS PER 6"	INCHES DRIVEN/ INCHES RECOV'D	BULLNOSE BLOWS/FT	DEPTH (FEET)	USCS CODE	DESCRIPTION OF SUBSURFACE CONDITIONS	DRY DENSITY (PCF)	MOISTURE (%)
RS	15 28	12/12		1 2 3 4	SC	GRAVELLY SAND with clay; brown, slightly moist, medium dense, low to medium plasticity Weak cementation Dense	111	11.4
SS	25/2			5 6 7 8 9 10 11	SM/GM	GRAVELLY SAND/SANDY GRAVEL some silt; light brown, dry, very dense, nonplastic, 10-25% cobbles, moderate cementation		
				12 13 14 15 16 17 18 19 20 21 22 23 24 25		BOTTOM OF HOLE AT 11 FEET 5 INCHES *No Free Water Encountered*		

Sample Type Key:
SS = Split Spoon H = Hand Sample
RS = Ring Sampler R = Refusal
AC = Auger Cuttings

Drilling Equipment:
Mobile B-53 Drill Rig equipped with 6-5/8" OD x 3-1/4" ID hollow-stem, continuous-flight auger

PATTISON EVANOFF ENGINEERING, L.L.C.

1129 North Winstel Boulevard Tucson, Arizona 85716 Phone: (520) 881-1234

BORING NUMBER **B-10** SHEET 1 OF 1

Client: Pima Land Co./Empire Interchange L.P.

Project: Mountain View Estates, Phase I
Location: North of Marsh Station Road, East of SR.83

Location of Boring: SEE SITE PLAN

Elevation: Datum:

Logged By: R.J. Date: 02/21/01

Surface Conditions or Remarks:

SAMPLE TYPE	BLOWS PER 6"	INCHES DRIVEN/ INCHES RECOV'D	BULLNOSE BLOWS/FT	DEPTH (FEET)	USCS CODE	DESCRIPTION OF SUBSURFACE CONDITIONS	DRY DENSITY (PCF)	MOISTURE (%)
H				1	SC	GRAVELLY SAND with clay; brown, slightly moist, medium dense, low to medium plasticity, 5-20% cobbles		
				2		Dense, weak cementation		
				3	SM/GM	GRAVELLY SAND/SANDY GRAVEL some silt; light brown, dry, very dense, nonplastic, 20-35% cobbles, weak cementation		
				4				
				5				
				6				
				7				
				8				
				9				
				10		BOTTOM OF HOLE AT 10 FEET		
				11		*No Free Water Encountered*		
				12				
				13				
				14				
				15				
				16				
				17				
				18				
				19				
				20				
				21				
				22				
				23				
				24				
				25				

Sample Type Key:
SS = Split Spoon H = Hand Sample
RS = Ring Sampler R = Refusal
AC = Auger Cuttings

Drilling Equipment:
Mobile B-53 Drill Rig equipped with 6-5/8" OD x 3-1/4" ID hollow-stem, continuous-flight auger

PATTISON EVANOFF ENGINEERING, L.L.C.

1129 North Winstel Boulevard Tucson, Arizona 85716 Phone: (520) 881-1234

BORING NUMBER **B-11**

SHEET 1 OF 1

Client: Pima Land Co./Empire Interchange L.P.

Project: Mountain View Estates, Phase I
Location: North of Marsh Station Road, East of SR.83

Location of Boring: SEE SITE PLAN

Elevation: Datum:

Logged By: R.J. Date: 02/21/01

Surface Conditions or Remarks:

SAMPLE TYPE	BLOWS PER 6"	INCHES DRIVEN/ INCHES RECOV'D	BULLNOSE BLOWS/FT	DEPTH (FEET)	USCS CODE	DESCRIPTION OF SUBSURFACE CONDITIONS	DRY DENSITY (PCF)	MOISTURE (%)
				1	GM	SANDY GRAVEL some silt; brown, slightly moist, dense, nonplastic, 20-35% cobbles		
				2		Light brown, dry, very dense, strong cementation		
				3				
				4		AUGER REFUSAL AT 4 FEET *No Free Water Encountered*		
				5				
				6				
				7				
				8				
				9				
				10				
				11				
				12				
				13				
				14				
				15				
				16				
				17				
				18				
				19				
				20				
				21				
				22				
				23				
				24				
				25				

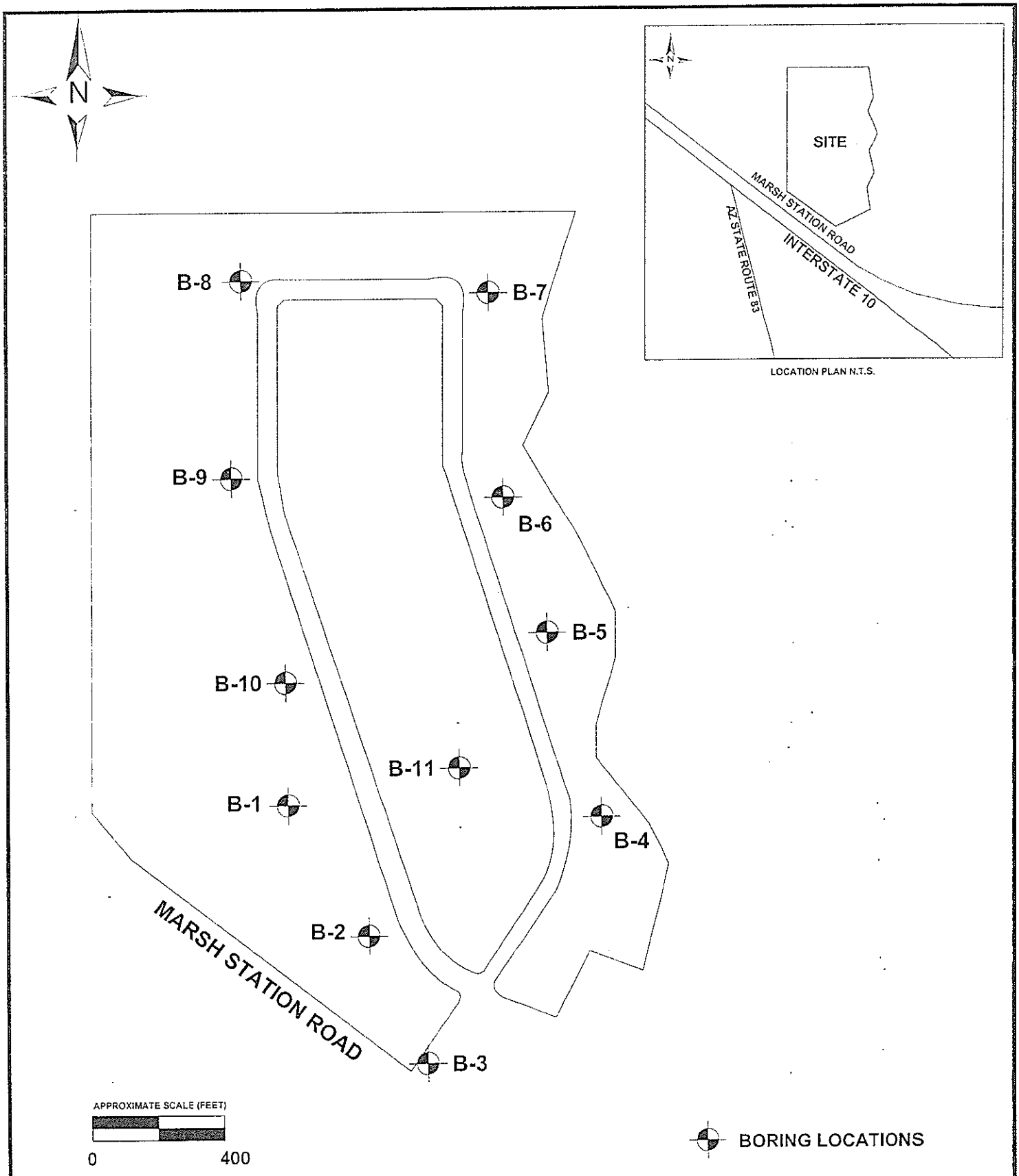
Sample Type Key:
SS = Split Spoon H = Hand Sample
RS = Ring Sampler R = Refusal
AC = Auger Cuttings

Drilling Equipment:
Mobile B-53 Drill Rig equipped with 6-5/8" OD x 3-1/4" ID hollow-stem, continuous-flight auger

Boring No.	Depth, ft.	Initial Dry Density, pcf	Initial Water Content, %	Compression Properties		Expansion Properties	
				Applied Pressure, ksf	Total Compression, %	Applied Pressure, ksf	Total Expansion, %
B-4	1.5	122	10.7	1.5	2.5		
"				1.5*	2.5		

* Sample Inundated With Water

Sample Location	Depth (ft)	Soil Class.	Liquid Limit	Plasticity Index	Percent Passing No. 200 Sieve
B-1	0	SC	29	11	32
B-3	0	SC	31	12	24
B-5	0	SC	29	11	43
B-10	0	SC	29	8	23



PATTISON ➢ EVANOFF ➢ ENGINEERING, L.L.C.

Geotechnical & Environmental Consultants

SITE AND EXPLORATION LOCATION PLAN

Mountain View Estates - Phase I

Northeast of I-10 and Sonoita Highway

Pima County, Arizona

Project No. 01-051 EAG 20MAR01